Space Weather Technical Forecast

Issued on Friday, 27 May 2022 at 01:23 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of R1-R2 Radio Blackouts declining. CME arrival likely early day 2 (28th) with G1/G2 Minor to Moderate Storm intervals likely.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low, with activity limited to C-class flares. There are currently seven sunspot regions on the visible disc, with a very faint 2019 recently re-appearing. The most notable region remains AR3014, but as it is now very close to the northwest limb this makes it difficult to assess. However, the Dkc/beta-gamma-delta configuration is maintained, as notable looping persists on SDO imagery. AR3017 has continued to simply, losing the penumbra on the trailing spots. All other regions are small, simple and stable.

A weak CME from yesterday morning has been observed in imagery and maybe Earth-directed. The CME has an unknown source.

Solar Wind / Geomagnetic Activity: The solar wind observed by DSCOVR at L1, has remained at background levels, gradually declining to end the day around 300 km/s. Density was initially below average density, but slowly increased through the day to become above average. Total magnetic field strength was predominantly weak, but did briefly peak at moderate levels, reaching 8 nT during the evening. The north-south component also either weakly negative or positive. Phi angle was positive (away from the Sun) for much of the period, but rotated to negative orientation from 26/2000UTC. Total geomagnetic activity was Quiet (Kp 1-2).

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV) has been at background levels through the last 24 hours. The high energy electron flux (greater than 2 MeV) has been mainly been at background to moderate levels, with a peak value of 776 pfu at 26/1620UTC. Corresponding electron fluence remained well below the Active threshold (1e8 integrated pfu), with an initially falling then increasing trend, reaching 2.5e7 integrated pfu at 27/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be mainly Low, but with a risk of isolated M-class activity and a very slight risk of X-class activity. The regions that are most likely to produce a significant flare are two active regions in the northwest quadrant, with the risk decreasing as the most complex region AR3014 soon rotates off the west limb.

Solar Wind / Geomagnetic Activity: Current ambient solar winds are likely to become enhanced today due to the arrival of the fast wind of CH84, with some potential influence from CH85. In addition a CME is expected to arrive early tomorrow at 28/0200 +/- 9 hours. This is likely to be a glancing impact, with solar winds easing back towards background day during 3 (29th).

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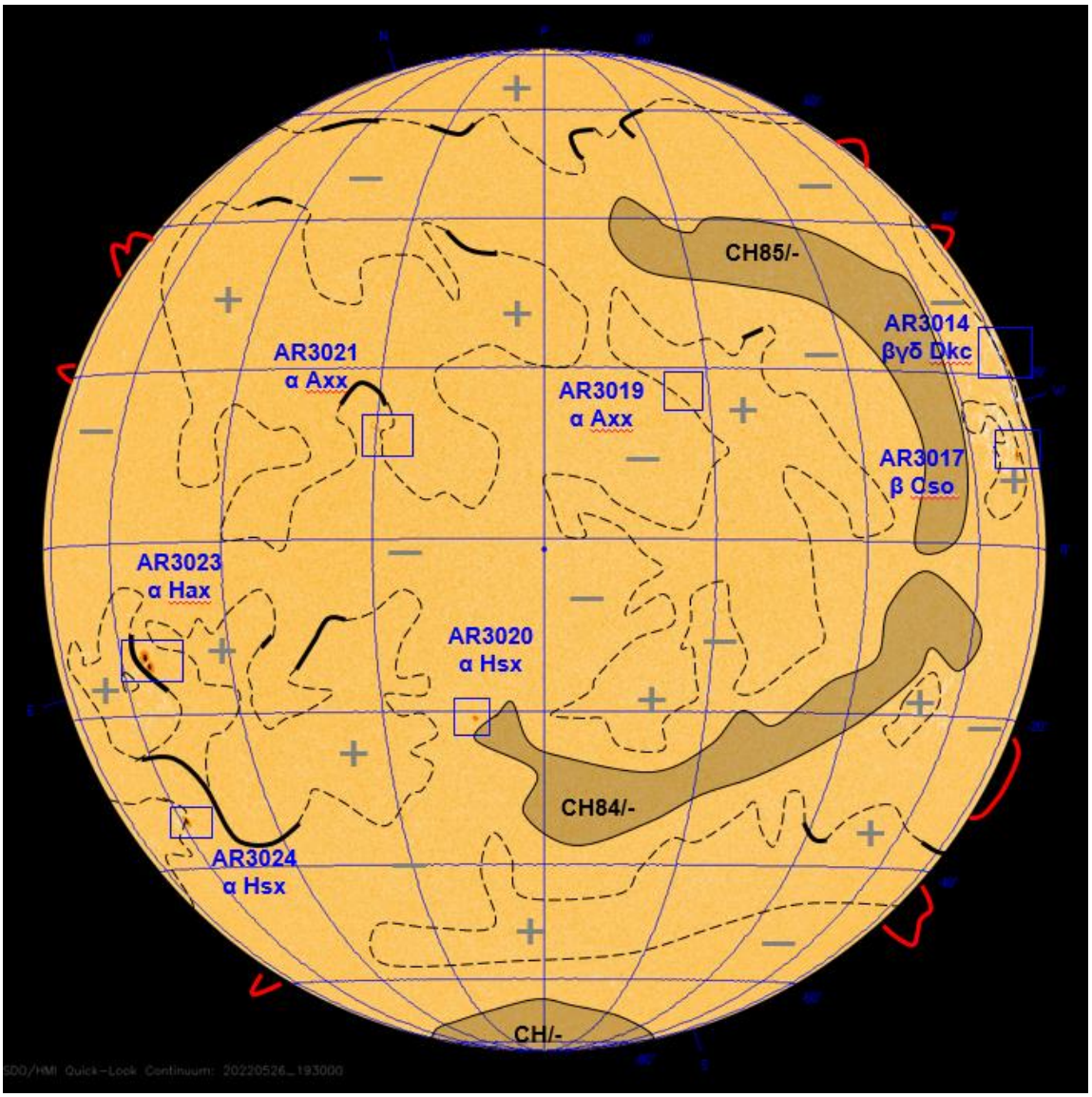
Met Office Space Weather Technical Forecast

Quiet (Kp 0-2) geomagnetic activity at first is likely to become Unsettled to Active (Kp 3-4) today (27th) with a slight chance of G1/Minor Storms (Kp 5) under the arrival of a CIR and then high speed stream. The impact of the CME, from the 25th, gives a likelihood of G1/Minor Storms with a chance of G2 Moderate (Kp 6) storms, most likely early tomorrow (28th). Geomagnetic activity then decreases from day 3 (29th).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) is expected to be at background levels during this period, with a slight chance of reaching S1/Minor Storm levels if any notable flares occur from the sunspot regions on the northwest limb. High energy electron flux (greater than 2MeV) is expected to remain below the high (1e3 pfu threshold) with the electron fluence remaining below the Active (1e8 integrated pfu) threshold. Although fluence potentially rising day 3 with high flux possible.

Figure 1. Solar Analysis Valid 26/1930 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

The CME from M1.3 flare of ex-3016 has been analysed as giving a glancing impact to Earth at 28/0200 UTC +/- 9 hours. No further Earth-directed CMEs are currently expected.

Solar winds are currently at background, but expected to become enhanced later day 1 and into day 2 (26th and 27th) by the arrival of the fast wind of coronal hole 84, with some influence possible from 85. This is a longitudinal extensive feature, with elevated solar winds potentially persisting for much of the period. These are likely to peak around 550-600 km/s.
Quiet geomagnetic activity at first day 1 (26th) is likely to become Unsettled to Active into day 2 (27th) with the coronal hole fast wind arrival, with a slight chance of G1 Minor Storms. The impact of the CME gives a likelihood of G1/Minor Storms with a chance of G2 Moderate storms, most likely early day 3 (28th). Geomagnetic activity then easing day 4 (29th).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	40	60	10	5
Strong	G3	No	1	5	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
25/2200	Partial	Ex-AR3016	40W 20S	1010	28/0200 UTC +/- 9 hours	Glancing blow

Figure 2: Met Office Enlil model.

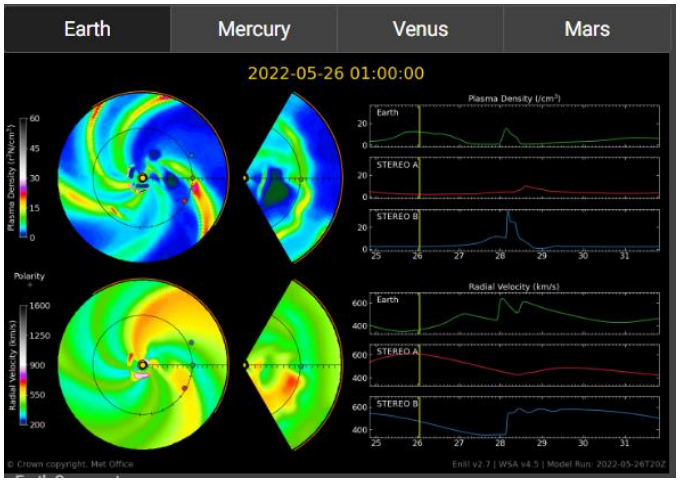

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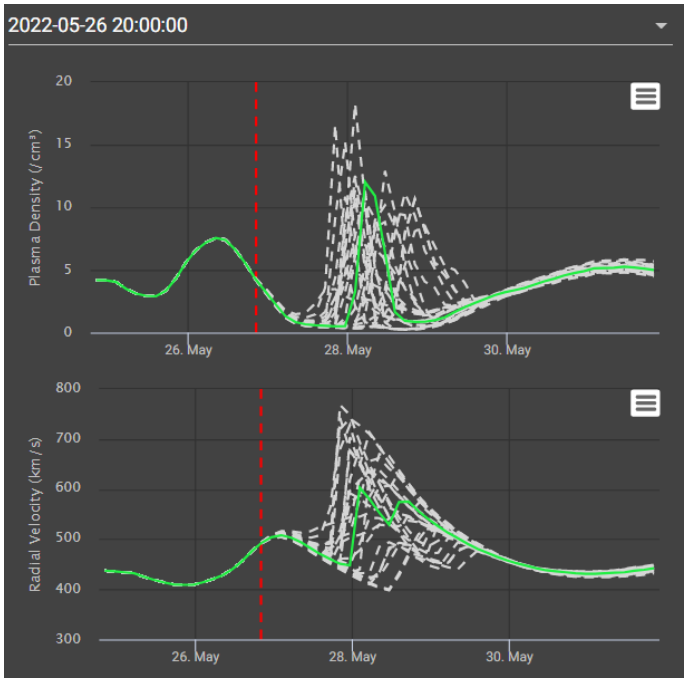
Figure 3: Met Office Enlil model ensemble, showing a range of arrival times for the CME from the 25th.



Radio Blackouts - X-Ray Flares:

Solar activity is Moderate, with one M1.3 flare observed from the region of ex-AR3016 at 25/1824UTC. There are currently six sunspot regions on the Earth-facing disc. The most notable is the large region AR3014, Dkc/beta-gamma-delta, which is now approaching the west limb. This regions is increasingly hard to assess, however has seen very little growth or decay in the last few days, and hence its classification is maintained as it approaches the limb. AR3017 Dso/Beta, also had a recent delta spot development to the north of its trailer, but has subsequently seen this decline with the umbra of the trailer becoming less visible. AR3023 Hhx/alpha was also originally considered a bipolar region with a delta, but this has been reassessed as a unipolar spot as it has moved into a clearer view. The other three regions are smaller and simpler.

Current activity is likely to become Low with a chance of Moderate, due to any further M-class flaring, with only a slight chance of isolated X-class flares, primarily from AR3014 as it rotates over the west limb.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	30	20	5	5
Very Active	R3 to R5 X Class	No	5	2	1	1

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Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) is at background levels and is most likely to remain so through the period. There is a slight, but decreasing risk of increased proton flux, and solar radiation storms, as AR3014 and AR3017 rotate off the Earth-facing disc and over the east limb.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	10	5	2	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

The High energy electron flux (as measured by GOES-16) is currently at background to Moderate, with a declining trend. This is likely to drop out with any fast wind arrival later day 1 (26th), and with any subsequent CME arrival, most likely early day 3 (27th). As any CME influence recedes, High flux is possible by the end of day 4 (28th).

The associated 24 hour fluence is expected to remain at background with no notable extended periods of high flux expected through the period, although likely increasing day 4 (29th). This is supported by REFM, which shows a declining trend for days 1-3 (26th-28th).

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	5	20
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 4: Met Office REFM model.

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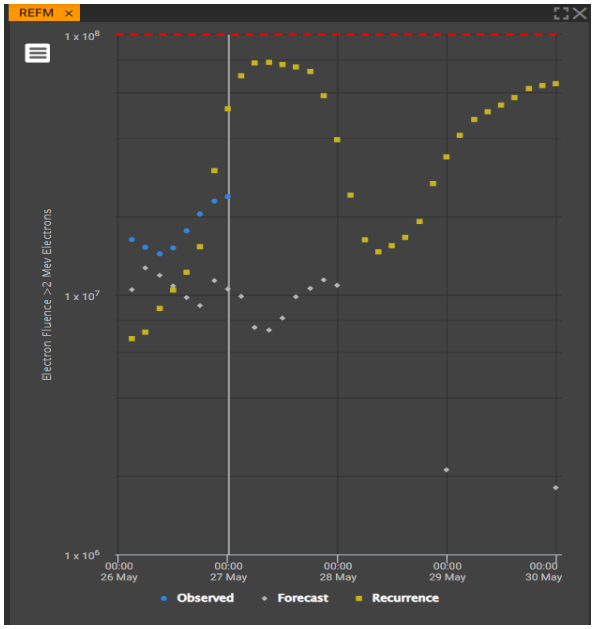

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